· A thin plate spline deformation, adapting the original fluence$_0$ into fluence$_X$. In contrast to Ref.[1] marker positions are used instead of organ contours.
· An adapted leaf motion, calculated in Eclipse (Varian Medical Systems, Palo Alto, CA).
For the dosimetric step ray tracing[5] is used to calculate the radiological path length *d*, from the source to each marker. Next, the tissue to phantom ratio, *TPR(0.5,d)*, is calculated using a fixed 0.5cm field size. The TPR_{planX} / TPR_{plan0}-median over the different markers rescales the number of monitor units of each beam.
For validation a 5 beam sliding window IMRT plan is optimized for the TG119 prostate structures[2]. The phantom is extended with 4 markers and bony anatomy. The initial plan$_0$ delivers 77Gy(2.2Gy/Fr). Fractions are simulated by applying translations and isotropic scaling using literature values (Table 1). The isotropic expansion is derived from the shrinkage factor, and is used to evaluate the robustness of our approach.

	Type	Magnitude	Structures
T1	Rigid translation[3] (Lat, Vrt, Lng) [mm]	(-0.4, 2.5, -2.6)	All
T2		(-4.7, 8.2, -8.0)	
T3		(-9.0, 14.9, -13.4)	
S1	Isotropic shrinkage[4]	Expansion factor = 0.9	Target + Markers
E1	Isotropic expansion[4]	Expansion factor = 1.1	

Table 1: Overview of the applied deformations. The type and magnitude are listed in column 2 and 3. Column 4 indicates on which structures the deformations are applied.

Results: Results are compared to plan$_0$ and our clinical standard: shifting of the phantom according to the detected marker positions, see Figure 1.
The combination of the geometric and dosimetric adaptation results in an identical target coverage as was intended (plan$_X$ = plan$_0$). The geometric adaptation alone reduces target coverage compared to plan$_0$ (upper left), similar as our clinical practice (upper row, dashed line (left) vs. solid gray line (right)). All translations have similar results.

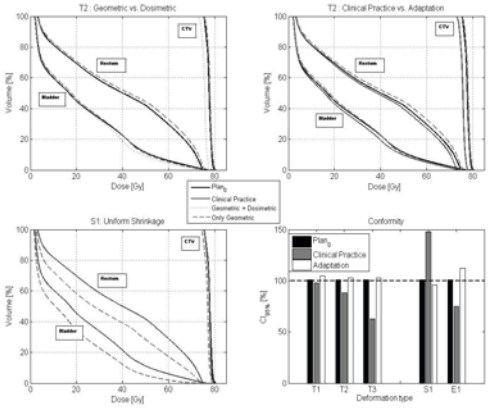

Figure 1. The DVH and conformity results. DVHs of a transformation (T2 upper row), and target shrinkage (S1,E1 lower row) are depicted.

For S1 and E1 a strongly improved conformity is observed for the adaptation compared to the clinical practice (Figure1). The adaptation ensures a stable, better CI_{95} compared to our clinical practice for all applied deformations, this indicates better OAR protection.
Conclusions: Target coverage, conformity, and as consequence OAR protection is improved by the presented non-MU preserving adaptation.
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PO-0848
Image-guided lung stereotactic treatments with the vero system
C. Garibaldi[1], A.M. Ferrari[2], S. Comi[1], A. Surgo[2], G. Piperno[2], F. Pansini[1], M. Cannella[2], A. Rampinelli[2], D. Ciardo[2], R. Orecchia[2]
[1]*European Institute of Oncology, Medical Physics, Milan, Italy*
[2]*European Institute of Oncology, Radiation Oncology, Milan, Italy*

Purpose/Objective: To analyse the accuracy of image-guidance using the cone-beam CT technology of the VERO SBRT system in stereotactic radiotherapy of lung tumors.
Materials and Methods: So far 22 consecutive patients have been treated with stereotactic treatment using the VERO system (BrainLAB AG, Mitsubishi Heavy Industries). A free breathing CT scan and a 10-phase respiration correlated 4D-CT to allow patient-specific motion assessment were acquired with a slice thickness of 2.5 mm. The Real-time Position Management respiratory gating system (RPM, Varian) was used to generate the external breathing signal and to retrospectively correlate cine CT images with the breathing phases. Patients, positioned supine with an arm holder (Posirest, Civco), were trained to achieve a regular breathing with the aid of a wearable display showing the breathing cycle. The internal target volume (ITV) was obtained contouring the tumor on the reconstructed maximum intensity projection and the mean intensity projection CT images. The PTV was generated with a safety margin of 5 mm to account for setup uncertainties. Treatment plans, consisting of 1-3 non coplanar conformal dynamic arcs or multiple IMRT fields, were generated for the VERO system. Doses between 25 and 54 Gy were delivered to the isocenter in 3 to 5 fractions. Patients were setup according to Exactrac and target localization was achieved with a kV-CBCT. Due to the limited field of view, in most of the cases the vertebral spine was not visible for evaluation of the patient set-up. The clipbox for automatic soft-tissue registration of the CBCT and the planning CT was confined around the lesion. The radiation oncologist then performed a manual registration to adjust the position of the ITV and PTV to the motion-blurred tumor in all three planes in the CBCT. Translational and rotational target localization errors were corrected with the 5 degree-of-freedom robotic couch and the ring rotation. A verification CBCT was acquired after correction to evaluate residual errors. If residual error was greater than 2 mm in any direction, a second correction was made and another CBCT acquired.
Results: In the table are shown the group mean, the systematic (Σ) and random (σ) component of the tumor localization errors and residual errors after correction, in terms of translations and rotations. Data were obtained from the analysis of 168 CBCTs. The mean 3D vector at initial set-up was 5.7±1.4 mm, while was significantly reduced to 1.4±0.6 mm after 6D automatic correction.

		Translations (mm)				Rotations (°)		
		LR	SI	AP	3D vector	roll	pitch	yaw
Tumor localization	**Group mean**	**0.5**	**1.7**	**-3.4**	**5.7**	**0.6**	**0.0**	**0.1**
error	**Σ**	**1.2**	**3.2**	**1.9**	**1.4**	**0.7**	**1.0**	**1.0**
	σ	**1.7**	**2.3**	**1.9**	**1.9**	**0.8**	**0.9**	**1.4**
Residual error	**Group mean**	**-0.1**	**0.0**	**0.0**	**1.4**	**-0.1**	**0.0**	**0.0**
	Σ	**0.5**	**0.7**	**0.6**	**0.6**	**0.3**	**0.2**	**0.3**
	σ	**0.5**	**1.0**	**1.0**	**1.0**	**0.4**	**0.4**	**0.3**

Conclusions: On-line CBCT image guidance and automatic 6D correction available on the VERO system allowed a very accurate tumor localization in lung stereotactic treatments. A post-treatment CBCT will be acquired in the next group of patients to assess the safety margins required to compensate for residual positional uncertainties and intra-fraction tumor displacement.

PO-0849
Dose coverage of lymph nodes in treatments corrected for daily baseline shift of the primary tumour
T.B. Nielsen[1], C. Brink[1]
[1]*Laboratory of Radiation Physics, Odense University Hospital, DK-5000 Odense, Denmark*

Purpose/Objective: Treatment planning and irradiation of lung cancer patients are often based on the mid-ventilation phase in order to minimize planning margins. The primary lung tumour and involved lymph node located in the mediastinum region can have different respiratory patterns. There can be a systematic baseline shift across the entire treatment course between the primary tumour and the lymph node as well as daily random baseline variations. It is desirable to correct for baseline shifts that occurs daily for the primary lung tumour but that might cause a discrepancy between the planned and delivered dose distribution to the lymph node. This study investigates the dose coverage of the lymph node when the entire dose distribution is shifted in accordance with baseline shift of the primary tumour.